More interference and Relativity

Equations:

Single Slit interference:

$$a \sin\theta = \lambda$$

a is the width of the slit, θ is the angle to the first MINIMUM.

Dispersion Limited Resolution of a Lens:

$$\theta = 1.22\frac{\lambda}{D}$$

θ is the minimum angle two objects may be separated by (in radians) and still be resolved by a lens of diameter D.

Relatisitic Lorentz factor:

$$\gamma \equiv \frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$$

Lenth Contraction, Time lengthening:

$$L = \frac{L_0}{\gamma} \qquad T = \gamma T_0$$

L_0 / T_0 are lengths / times measured in frame of moving object/clock.

Redshift, relativistic analog of Doppler effect:

$$f = f_0\sqrt{\frac{1-v/c}{1+v/c}}$$

where v is the velocity with which the source moves away from the observer, and f_0 is the frequency as measured in the frame of the source.

Relativistic addition of velocities:

$$u = \frac{u'+v}{1+\frac{u'v}{c^2}}$$

where u' is the velocity of an object measured by a moving observer with velocity v and u is the velocity of the the object measured by an observer at rest.

Relativistic energy and momentum:

$$E_0 = mc^2 \qquad E = m\gamma c^2 \qquad KE = E - E_0 \qquad p = m\gamma v$$

where E_0 is the energy of an object at rest, E and KE are the energy and kinetic energy respectively and p is the object's momentum.

Assorted Facts:

1. The speed of light is the same in all reference frames.
2. An "event" is described by a time and a position.
3. The time-ordering of events might depend on the reference frame, unless light from one event can reach the second event before it occurs.
4. Moving clocks run slow and moving meter sticks are short.
5. For light from a source moving away from an observer, frequencies appear slower and wavelengths are longer than those observed in the frame of the moving source.
6. If energy leaves a system the mass will decrease.